WHAT IS CLAIMED IS:

1. An excimer or molecular fluorine laser, comprising:

a laser tube filled with a laser gas;

an optical resonator;

a discharge circuit; and

a plurality of electrodes within the laser tube connected to a discharge circuit for exciting the laser gas to produce a laser output beam, said discharge circuit including a solid state switch configured to switch a voltage needed to produce desired pulse energies without having a step-up transformer disposed within the circuit after the switch.

2. The laser of claim 1 wherein said solid state switch includes a plurality of insulated gate bipolar transistors (IGBT).

3. The laser of Claim 2, wherein the plurality of IGBTs includes at least three IGBTs connected in series.

4. The laser of Claim 2, wherein the plurality of IGBTs includes at least two series combinations of one or more IGBTs connected in parallel.

5. The laser of claim 1 wherein the solid state switch is configured to switch a voltage signal in excess of 12 kV.

6. The laser of claim 5 wherein the solid state switch has a rise time of less than 300 ns.

7. The laser of claim 5 wherein the solid state switch has a rise time of less than 100 ns.

8. The laser of claim 1 wherein an additional load is coupled between the

main discharge electrodes and peaking capacitors from which current pulses are applied to the electrodes.

9. The laser of claim 8 wherein said additional load includes a resistor.

10. The laser of claim 1 wherein peaking capacitors from which current pulses are applied to the electrodes are positioned as close as possible to the electrodes, and sustainer capacitors have an enlarged inductance between them and the discharge electrodes for extending the current pulse.

11. The laser of claim 1 further including a protective circuit coupled in parallel to said solid state switch.

12. The laser of claim 11 wherein said protective circuit includes a diode and a saturable inductor.

13. The laser of claim 11 wherein said protective circuit includes a resistor and a capacitor connected in series.

14. An excimer or molecular fluorine laser, comprising:

a laser tube filled with a laser gas;

an optical resonator;

a discharge circuit;

a plurality of electrodes within the laser tube connected to the discharge circuit for exciting the laser gas to produce a laser output beam, said discharge circuit including a solid state switch configured to switch between half and a quantity less than a voltage needed to produce desired pulse energies without having a step-up transformer disposed within the circuit after the switch, and

wherein the discharge circuit includes a voltage doubling circuit configured to approximately double the voltage signal applied to a pulse

compressor circuit before the pulse reaches the electrodes.

15. The laser of claim 14 wherein the solid state switch is configured to switch at least 10 kV.

16. The laser of claim 14, wherein said solid state switch includes a plurality of insulated gate bipolar transistors (IGBTs).

17. The laser of Claim 16, wherein the plurality of IGBTs includes at least three IGBTs connected in series.

18. The laser of Claim 16, wherein the plurality of IGBTs includes at least two series combinations of one or more IGBTs connected in parallel.

19. The laser of claim 14, wherein the voltage doubling circuit includes a pair of capacitors.

20. The laser of claim 19 wherein each of said pair of capacitors includes a plate connected to an output of the switch.

21. The laser of claim 20 wherein a second plate of a first of said pair of capacitors is coupled to the pulse compressor circuit and a second plate of a second of said pair of capacitors is coupled to a ground terminal.

22. The laser of claim 21, wherein the dischare circuit is configured such that when the switch closes, the pair of capacitors are each configured to acquire a voltage substantially equal to the voltage of a main initial storage capacitor charged prior to the switch being closed, and the sum of the voltages across the pair of capacitors being double the switching voltage such that the switching voltage is approximately half the voltage applied at the main laser

discharge electrodes.

23. An excimer or molecular fluorine laser, comprising:

a laser tube filled with a laser gas;

an optical resonator;

a discharge circuit; and

a plurality of electrodes within the laser tube connected to a discharge circuit for exciting the laser gas to produce a laser output beam, said discharge circuit including an solid state switch, and

wherein the solid state switch is connected to each of an oscillator laser discharge circuit and an amplifier laser discharge circuit,

wherein an electrical pulse applied to the amplifier laser discharge circuit is delayed from that applied to the oscillator laser discharge circuit;

wherein an output pulse from the oscillator laser is optically directed into the laser tube of the amplifier laser at a substantially same time as when the electrical pulse is applied to the discharge circuit of the amplifier laser; and

wherein the position of the oscillator laser pulse in the discharge region of the amplifier laser at the time of the discharge of the amplifier laser increases the output of the oscillator laser to a desired level.

24. The laser of claim 23 wherein the voltage across the switch is substantially the same as the voltage applied to the discharge electrodes of the oscillator laser, and is less than the voltage required to produce the substantially similar level of output pulse energy of the oscillator laser without the amplifier pulse.

25. The laser of claim 23 wherein the switch includes a plurality of IGBTs.

26. An excimer or molecular fluorine laser, comprising:

a laser tube filled with a laser gas;

an optical resonator;

a discharge circuit; and

a plurality of electrodes within the laser tube connected to a discharge circuit for exciting the laser gas to produce a laser output beam, said discharge circuit including a first solid state switch and a second solid state switch;

wherein the first solid state switch is connected to an oscillator laser discharge circuit and the second solid state switch is connected to an amplifier laser discharge circuit;

wherein an electrical pulse applied to the amplifier laser discharge circuit including the first switch is delayed from that applied to the oscillator laser discharge circuit including the second switch;

wherein an output pulse from the oscillator laser is optically directed into the laser tube of the amplifier laser at a substantially the same time as when the electrical pulse is applied to the discharge circuit of the amplifier laser; and

wherein the oscillator laser output in the discharge region of the amplifier laser at the time of the discharge of the amplifier laser increases the output energy of the oscillator laser to a desired level.

27. The laser of claim 26 wherein the voltage across the first switch is substantially the same as the voltage applied to the electrodes of the oscillator laser, and less than the voltage required to produce the same output pulse energy of the oscillator laser without the amplifier pulse.

28. The laser of claim 27 wherein said first and second switches are synchronized such that said delay is controlled.

29. The laser of claim 26 wherein a trigger signal applied to each of the first and second solid state switches is delayed before the second solid state switch.

30. An excimer or molecular fluorine laser, comprising:

a laser tube configured to be filled with a laser gas;

an optical resonator; and

a plurality of discharge electrodes disposed within a discharge chamber, the chamber including a pair of discharge electrodes coupled to a discharge circuit for exciting the laser gas for generating a laser output beam, the discharge circuit including a solid state switch comprised of a plurality of insulated gate bipolar transistors (IGBTs) configured to switch a voltage signal of between 12 and 25 kV.

31. The laser of claim 30 wherein the IGBTs have a rise time of less than 100 ns.

32. The laser of claim 31 further including a voltage doubling circuit configured to double the voltage signal applied to a pulse compressor circuit before the pulse reaches the discharge electrodes.

33. The laser of claim 32 wherein the voltage doubling circuit includes a pair of capacitors coupled in series.

34. The laser of claim 33 wherein each of said capacitors includes a plate connected to the output of the switch.

35. The laser of claim 30, wherein the plurality of IGBTs includes at least three IGBTs connected in series.

36. The laser of Claim 30, wherein the plurality of IGBTs includes at least two series combinations of one or more IGBTs connected in parallel.

37. A method of providing an excimer or molecular fluorine laser, comprising the steps of:

filling a laser tube with a laser gas;

providing an optical resonator; and

disposing a plurality of electrodes within a discharge chamber, the chamber including a pair of electrodes connected to a discharge circuit for exciting the laser gas to produce a laser output beam, said discharge circuit including an all solid state switch configured to switch a voltage needed to produce desired pulse energies without having a step-up transformer disposed within the circuit after the switch.

38. The method of claim 37 wherein said solid state switch includes a series of insulated gate bipolar transistors (IGBT), said discharge circuit not including a step up voltage transformer.

39. The method of claim 38 wherein said series of IGBTs are configured to switch a voltage signal of approximately 20 kV.

40. The method of claim 39 wherein the solid state switch has a rise time of less than 100 ns.

41. The method of claim 37 further including the step of doubling the voltage signal applied to the pulse compressor circuit before the pulse reaches the pair of electrodes.

42. The method of claim 41 wherein said doubling step includes the step of providing a voltage doubling circuit.

43. The method of claim 42 wherein said solid state switch includes a series

of insulated gate bipolar transistors (IGBT), said discharge circuit not including a step up voltage transformer.

44. The method of claim 43 wherein said series of IGBTs are configured to switch a voltage signal of approximately 20 kV.

45. An excimer or molecular fluorine laser system, comprising:

a laser tube filled with a gas mixture including an active halogen component;

a pulsed discharge circuit;

a plurality of electrodes within the laser tube connected to the discharge circuit for energizing the gas mixture; and

an optical resonator for generating a laser beam,

wherein the discharge circuit comprises:

a solid state switch for switching an electrical pulse provided by a main storage capacitor charged by a power supply;

a voltage doubling circuit including a pair of capacitors for doubling the voltage of the pulse switched by the solid state switch; and

a pulse compression circuit for compressing the pulse for application to the electrodes.

46. The laser system of Claim 45, wherein the voltage doubled by the voltage doubling circuit is sufficient for the laser system to produce laser pulses of desired energies without a step-up transformer.

47. An excimer or molecular fluorine laser system, comprising:

a laser tube filled with a gas mixture including an active halogen component;

a pulsed discharge circuit;

a plurality of electrodes within the laser tube connected to the discharge

circuit for energizing the gas mixture; and

an optical resonator for generating a laser beam,

wherein the discharge circuit comprises:

a solid state switch including a plurality of IGBTs for switching an electrical pulse provided by a main storage capacitor charged by a power supply, said electrical pulse having sufficient energy to produce laser pulses of desired energies without disposing a step-up transformer in the discharge circuit after the switch ;

a pulse compression circuit for compressing the pulse for application to the electrodes.

48. An excimer or molecular fluorine laser system, comprising:

an oscillator laser, including:

a first laser tube filled with a gas mixture including an active halogen component;

a first discharge circuit;

a first plurality of electrodes within the first laser tube connected to the first discharge circuit for energizing the gas mixture therein; and

a first optical resonator for generating a laser beam;

an amplifier, including:

a second laser tube filled with a similar gas mixture as said first laser tube;

a second discharge circuit;

a second plurality of electrodes within the second laser tube connected to the second discharge circuit for energizing the gas mixture therein;

a power supply;

a solid state switch for switching an electrical pulse provided by the power supply for providing the electrical pulse to each of the first and second discharge circuits; and

a delay coupled between the switch and the second discharge circuit, such that laser pulses emitted by the oscillator laser are amplified within the amplifier laser tube, wherein the laser system provides output pulses of desired energies.

49. The laser system of Claim 48, wherein the electrical pulses switched by the solid state switch are sufficient to provide output pulses of the laser system at the desired energies without a step-up transformer being disposed within the first discharge circuit.

50. The laser system of Claim 48, wherein the first optical resonator includes a line-narrowing module for narrowing a bandwidth of emitted laser pulses.

51. An excimer or molecular fluorine laser system, comprising:

an oscillator laser, including:

a first laser tube filled with a gas mixture including an active halogen component;

a first power supply;

a first discharge circuit;

a first solid-state switch for switching electrical pulses provided by the first power supply;

a first plurality of electrodes within the first laser tube connected to the first discharge circuit for energizing the gas mixture therein; and

a first optical resonator for generating a laser beam;

an amplifier, including:

a second laser tube filled with a similar gas mixture as said first laser tube;

a second power supply;

a second discharge circuit;

a second solid state switch for switching electrical pulses

provided by the second power supply;

a second plurality of electrodes within the second laser tube connected to the second discharge circuit for energizing the gas mixture therein,

wherein each of the first and second switches are configured to receive a trigger signal from a same trigger signal circuit, and the laser system further comprising a delay coupled between the trigger signal circuit and the second solid state switch, such that laser pulses emitted by the oscillator laser are amplified within the amplifier laser tube, wherein the laser system provides output pulses of desired energies.

52. The laser system of Claim 51, wherein the electrical pulses switched by the first and second solid state switches are sufficient to provide output pulses of the laser system at the desired energies without a step-up transformer being disposed within the first discharge circuit.

53. The laser system of Claim 51, wherein the first optical resonator includes a line-narrowing module for narrowing a bandwidth of emitted laser pulses.

54. An excimer or molecular fluorine laser, comprising:

a laser tube filled with a laser gas;

an optical resonator;

a discharge circuit;

a plurality of electrodes within the laser tube connected to the discharge circuit for exciting the laser gas to produce a laser output beam,

wherein said discharge circuit includes a solid state switch, and

wherein said discharge circuit further includes a protective circuit connected in parallel with said solid state switch for protecting said solid state switch against negative currents flowing back through said discharge circuit.

55. An excimer or molecular fluorine laser, comprising:

a laser tube filled with a laser gas;

an optical resonator;

~~a discharge circuit;~~

a plurality of electrodes within the laser tube connected to the discharge circuit for exciting the laser gas to produce a laser output beam,

wherein said discharge circuit includes a solid state switch, and

wherein said discharge circuit further includes a diode connected in parallel with said solid state switch for protecting said solid state switch against negative currents flowing back through said discharge circuit.

56. An excimer or molecular fluorine laser, comprising:

a laser tube filled with a laser gas;

an optical resonator;

a discharge circuit;

a plurality of electrodes within the laser tube connected to the discharge circuit for exciting the laser gas to produce a laser output beam,

wherein said discharge circuit includes a solid state switch, and

wherein said discharge circuit further includes a resistor-capacitor series combination connected in parallel with said solid state switch for protecting said solid state switch against negative currents flowing back through said discharge circuit.

57. An excimer or molecular fluorine laser, comprising:

a laser tube filled with a laser gas;

an optical resonator;

a discharge circuit;

a plurality of electrodes within the laser tube connected to the discharge circuit for exciting the laser gas to produce a laser output beam,

wherein said discharge circuit includes a solid state switch, and

wherein said discharge circuit further includes a diode and a saturable inductor series combination connected in parallel with said solid state switch for protecting said solid state switch against negative currents flowing back through said discharge circuit.

58. An excimer or molecular fluorine laser, comprising:

a laser tube filled with a laser gas;

an optical resonator;

a discharge circuit;

a plurality of electrodes within the laser tube connected to the discharge circuit for exciting the laser gas to produce a laser output beam,

wherein said discharge circuit includes a solid state switch, and

wherein said switch includes a series combination of at least two IGBTs.

59. An excimer or molecular fluorine laser, comprising:

a laser tube filled with a laser gas;

an optical resonator;

a discharge circuit;

a plurality of electrodes within the laser tube connected to the discharge circuit for exciting the laser gas to produce a laser output beam,

wherein said discharge circuit includes a solid state switch, and

wherein said switch includes a series combination of at least three to six IGBTs.

60. An excimer or molecular fluorine laser, comprising:

a laser tube filled with a laser gas;

an optical resonator;

a discharge circuit;

a plurality of electrodes within the laser tube connected to the discharge circuit for exciting the laser gas to produce a laser output beam,

wherein said discharge circuit includes a solid state switch, and

wherein said switch includes a series combination f at least two IGBTs, said series combination being connected in parallel with at least one additional IGBT.

61. An excimer or molecular fluorine laser, comprising:

a laser tube filled with a laser gas;

an optical resonator;

a discharge circuit;

a plurality of electrodes within the laser tube connected to the discharge circuit for exciting the laser gas to produce a laser output beam,

wherein said discharge circuit includes a solid state switch, and wherein said switch includes a parallel combination of IGBTs, each path of said parallel combination including at least one IGBT.